

NDCEE

National Defense Center for Environmental Excellence



DoD Executive Agent

Office of the
Assistant Secretary
of the Army
(Installations and
Environment)

Evaluating the Environmental Impact, Cost, and Performance of Biobased Alternatives

**Joint Services Environmental Management
Conference
May 21-24, 2007**

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BioPreferred – Background

- 2002 Farm Security and Rural Investment Act (FSRIA)
 - a.k.a. 2002 Farm Bill
 - H.R. 2646/P.L. 107-171
- Section 9002 Federal Procurement of Biobased Products
 - USDA: develop and implement program for designating biobased products
 - Federal Agencies: purchase designated biobased products when annual amount purchased \geq \$10,000 and a product meeting their requirements is readily available at a reasonable price
- Implemented by USDA Office of Energy Policy & New Uses

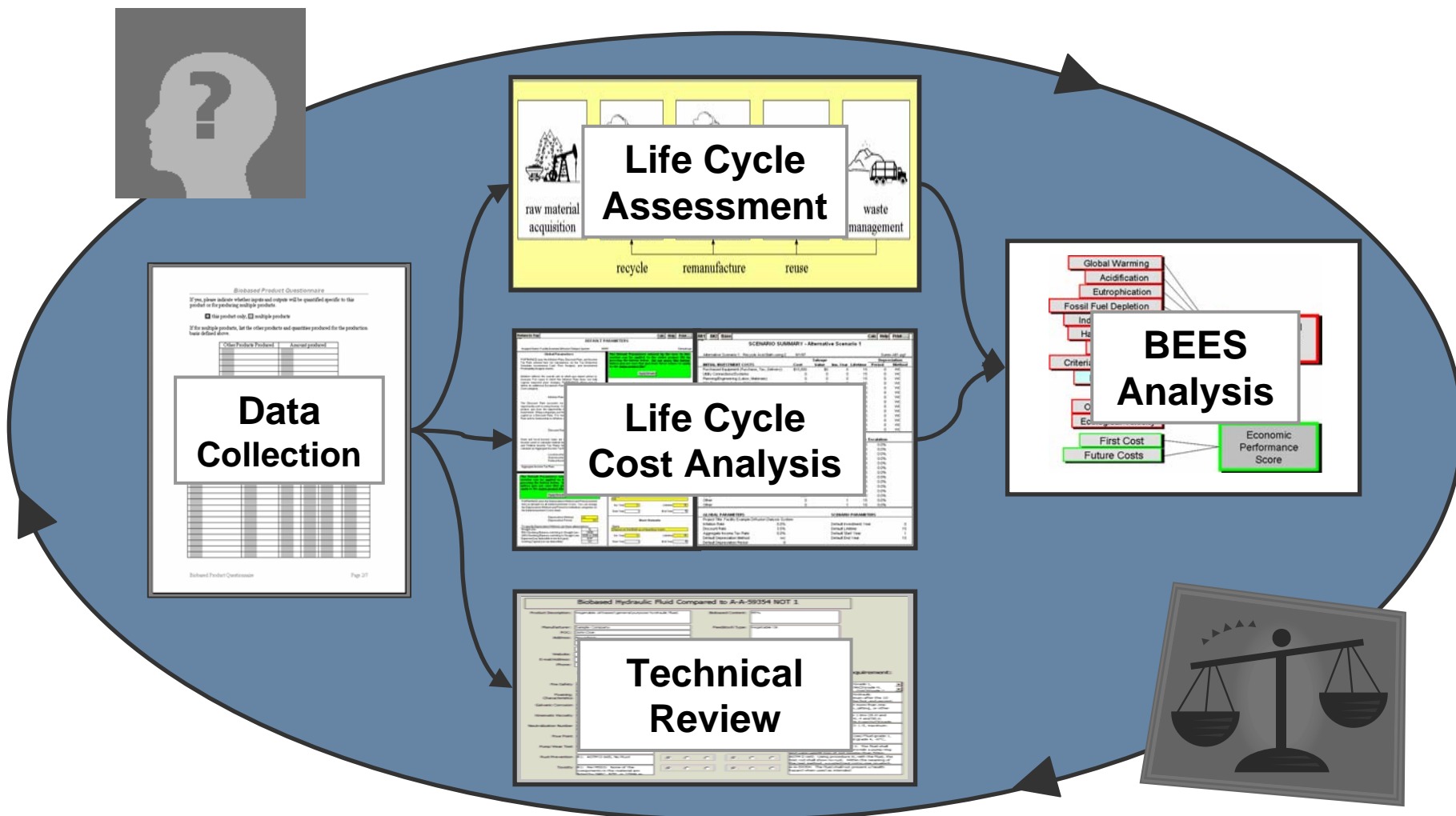
BioPreferred – Goals

- Create new jobs for rural communities
- Provide new markets for farm commodities
- Increase national security by lessening our dependence on foreign oil
- Improve the environment through the use of non-toxic, renewable resources
- Increase the government's purchase and use of biobased products

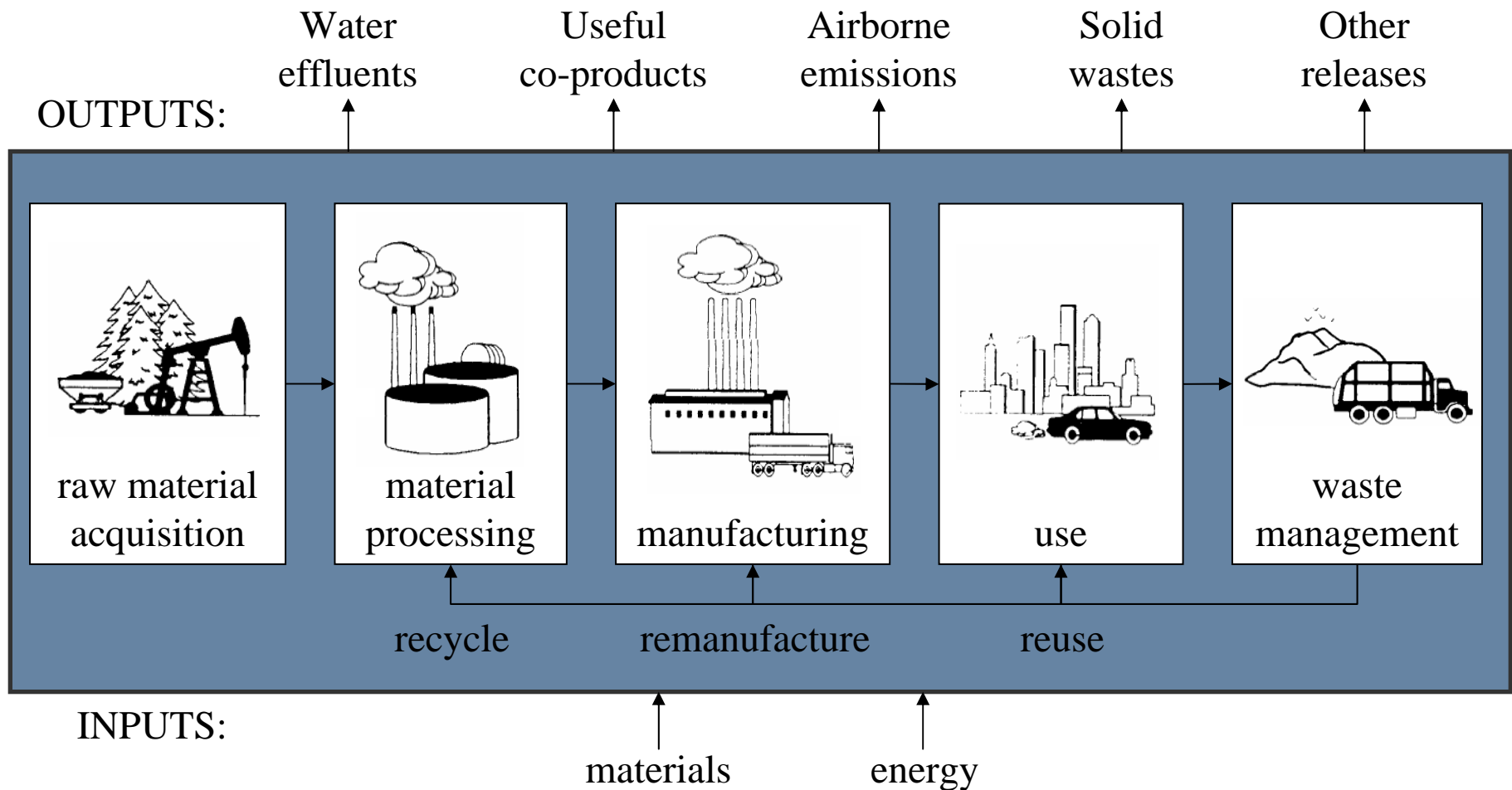
BioPreferred – Designation Items

- Categories of biobased products designated as preferred
 - Commercially available products identified
 - products evaluated against non-biobased counterparts
 - cost effectiveness
 - accessibility
 - performance
 - Sample products test for biobased content using ASTM D6866-04
 - Sample products evaluated using life cycle assessment (LCA) and life cycle cost analysis (LCCA) approaches used by the Building for Economic and Environmental Sustainability (BEES) tool

Framework – Evaluating Alternatives



Life Cycle Assessment



Life Cycle Cost Analysis

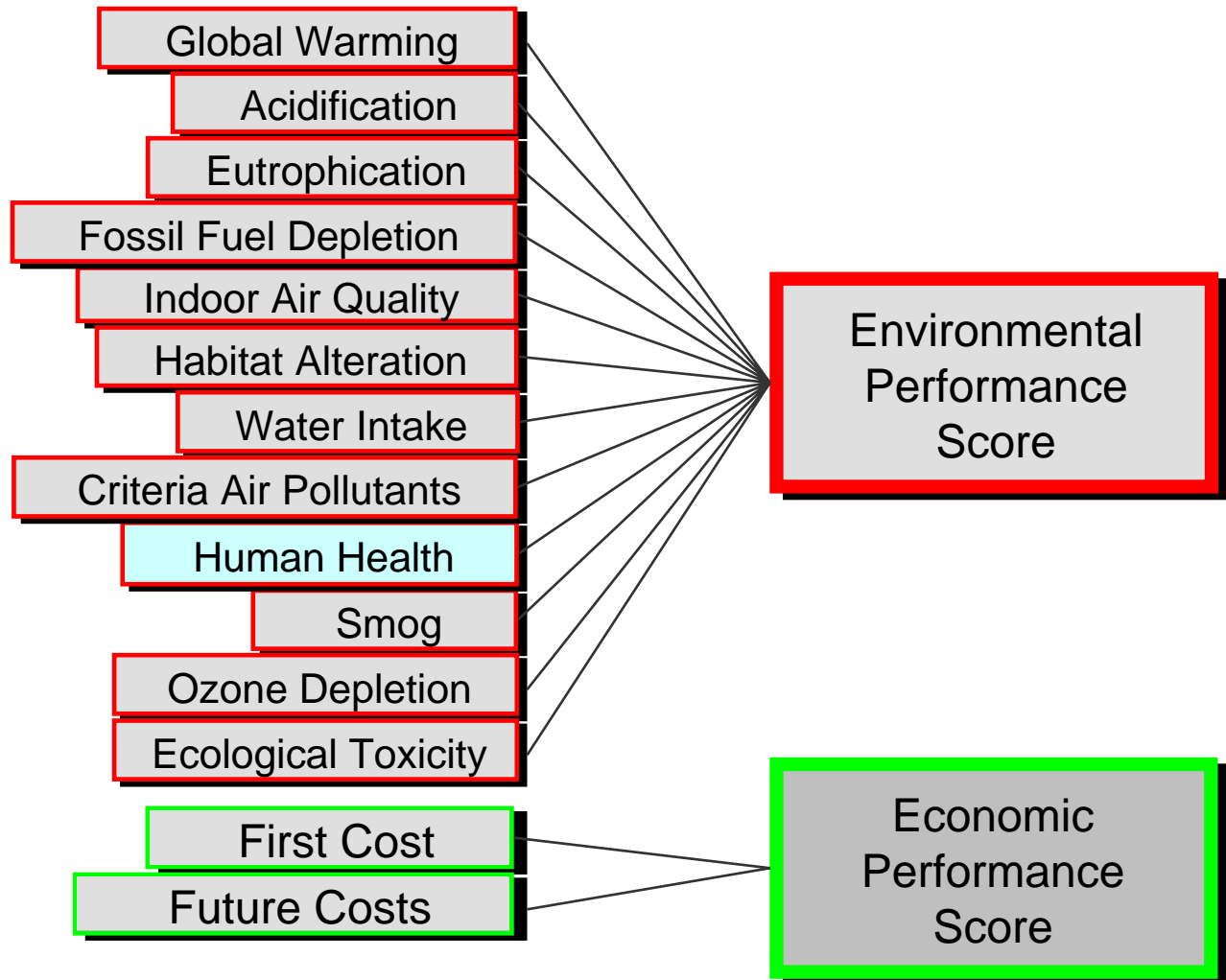
An economic analytical tool for estimating the total cost of acquisition and ownership of a system over its full life, including the cost of planning, development, manufacturing, acquisition, installation, operation, support, decommissioning, and disposal.

$$C_{LC} = C_R + C_P + C_U + C_R$$

The BEES Model

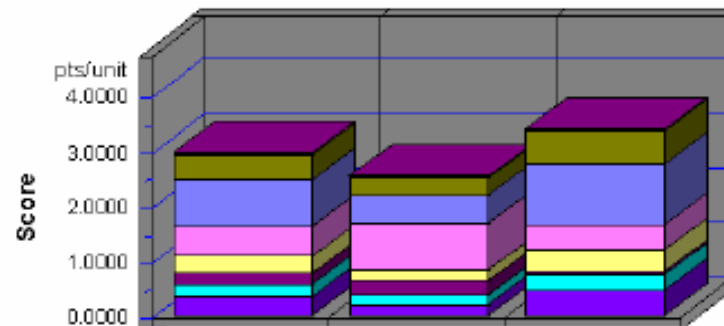
- BEES = Building for Environmental and Economic Sustainability
- Developed by National Institute of Standards and Technology (NIST)
 - Systematic methodology for selecting building projects
 - Methodology now applied to evaluate biobased materials
- Based on Consensus Standards
 - Life-Cycle Costing (ASTM E917)
 - Building Element Classification (ASTM E1557)
 - Environmental Life-Cycle Assessment (ISO 14040)
 - Multi-Attribute Decision Analysis (ASTM E1765)
- Publicly available

The BEES Model

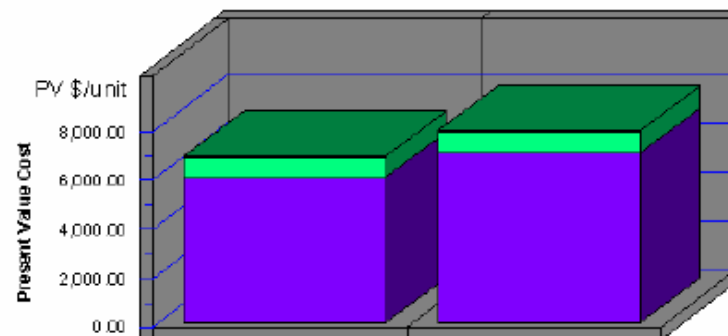
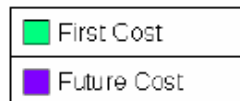


BEES Results

Environmental Performance



Economic Performance



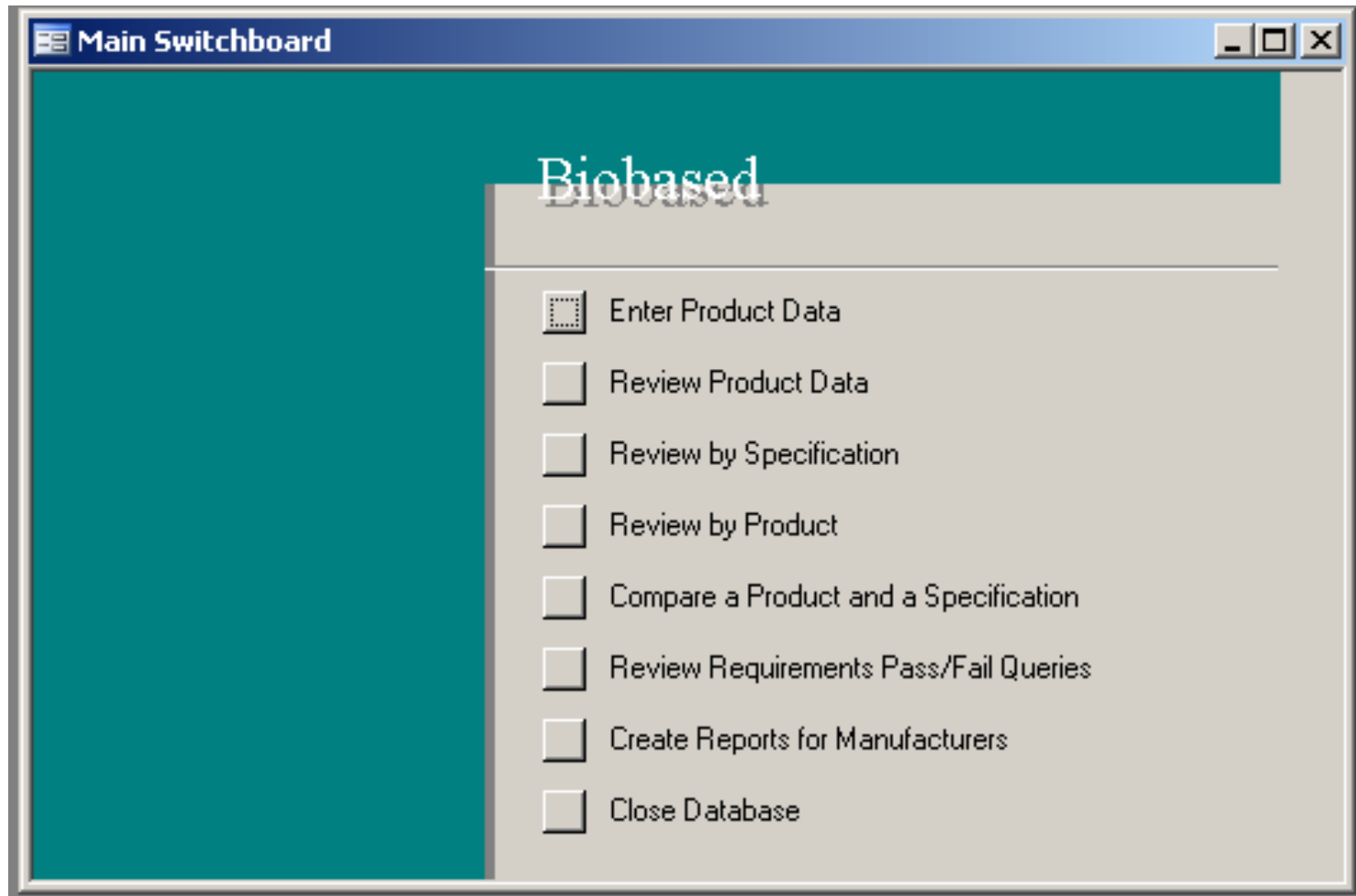
Technical Review

- Work with purchasing agency to identify corresponding Military Specifications and other Government purchasing requirements
- Identify biobased manufacturers and products
- Contact biobased manufacturers to collect product performance data on commercially available biobased products
- Collect information on biobased material content (minimum content levels established by USDA)

Technical Review

- Develop database containing product performance data, Government requirements
- Compare performance data to specifications
- Assign meets, does not meet or not enough information provided determination for each property of the specification or requirement
- Identify gaps between performance data and requirements
- Provide product performance reports to Agency and manufacturers

Biobased Product Database



<p>Product Name: <input type="text" value="Biobased Hydraulic Fluid"/></p> <p>Product Description: <input type="text" value="Vegetable oil based general purpose hydraulic fluid."/></p> <p>Manufacturer: <input type="text" value="Sample Company"/></p> <p>POC: <input type="text" value="John Doe"/></p> <p>Address: <input type="text" value="Anywhere"/></p> <p><input type="text"/></p> <p><input type="text"/></p> <p>Website: <input type="text"/></p> <p>E-mail Address: <input type="text"/></p> <p>Phone: <input type="text"/></p>	<p>Biobased Content: <input type="text" value="95%"/></p> <p>Feedstock Type: <input type="text" value="Vegetable Oil"/></p> <p>Product's Kinematic Viscosity: <input type="text" value="R1: ASTM D 445: @-15C, 100cSt; @40C, 34.9cSt; @100C,10.0cSt"/></p> <p>Date Added: <input type="text" value="9/15/2006 7:51:56 AM"/></p> <p>Last Updated: <input type="text" value="10/30/2006 9:04:08 AM"/></p>
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Meets Req.	Does Not Meet Req.	Not Enough Info	Select Property:	Kinematic Viscosity	
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>A-A-59290</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: 9.0 cSt, minimum at 37.7°C (100°F)</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>A-A-59354</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At 40°C: <input type="checkbox"/> Grade 1 btw 28.8 and 35.2 mm²/s (cSt) <input type="checkbox"/> Grade 2 btw 41.4 and 50.6 mm²/s <input type="checkbox"/> Grade 3 btw 61.2 and 74.8 mm²/s <input type="checkbox"/> Grade 4 btw 135 and 165 mm²/s</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-H-19457</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At 40°C: 38.5 - 45.5 cSt <input type="checkbox"/> At 100°C: min 4.8 cSt</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-H-81019</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At 100°C: 2.5 x 10-6 m²/s, min <input type="checkbox"/> At 40°C: 7.0 x 10-6 m²/s, min <input type="checkbox"/> At -54°C: 800 x 10-6 m²/s, max <input type="checkbox"/> At -70°C: 0.008 m²/s, max</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-PRF-32073</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At 40°C & at -15°C, conform to the specified requirements for each grade. (see NOTE 1)</p> </div> </div>					

Meets Req.	Does Not Meet Req.	Not Enough Info			
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-PRF-22072</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At -18°C(0°F): 1764(8100) cSt(SUS), max <input type="checkbox"/> At 38°C(100°F): 39.6 to 45.1 (185-210) cSt(SUS), min <input type="checkbox"/> At 54°C(130°F): 21.7(105) cSt(SUS), min</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-PRF-17672</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At 100°C(212°F): Report <input type="checkbox"/> At 40°C(104°F): <input type="checkbox"/> 2075 T-H, 28.8 to 35.2 cSt <input type="checkbox"/> 2010 T-H, 41.4 to 50.6 cSt <input type="checkbox"/> 2135 T-H, 61.2-74.8 cSt</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-PRF-5606</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At -54°C: 2500 cSt, max <input type="checkbox"/> At -40°C: 600 cSt, max <input type="checkbox"/> At 40°C: 13.2 cSt, min <input type="checkbox"/> At 100°C: 4.9 cSt, min</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-PRF-83282</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D 445: At 205°C: 1.0 cSt, min <input type="checkbox"/> At 100°C: 3.45 cSt, min <input type="checkbox"/> At 40°C: 14.0 cSt, min <input type="checkbox"/> At -40°C: 2,200 cSt, max</p> </div> </div>					
<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>MIL-PRF-87257</p> <p><input type="radio"/> <input type="radio"/> <input type="radio"/></p> </div> <div style="width: 55%;"> <p>ASTM D445: At 40°C: 6.7 cSt, min At 100°C: 2.0 cSt, min At -40°C: 550 cSt, max.</p> </div> </div>					

NOTE 1: MIL-PRF-32073 Table I

Property	Grade				
	1	2	3	4	5
Viscosity at 40°C, centistokes (cSt)	13.5 - 16.5	19.8 - 24.2	28.8 - 41.3	41.4 - 50.6	61.2 - 74.8
Viscosity at -15°C, cSt, maximum	300	500	1000	1600	2000
Viscosity index, minimum	135	135	184	184	184

Record: of 81

Biobased Hydraulic Fluid Compared to A-A-59354 NOT 1

Product Description:

Manufacturer:

POC:

Address:

Website:

E-mail Address:

Phone:

Biobased Content:

Feedstock Type:

Date Added:

Last Updated:

		Round 1:			Round 2:			Specification Requirement:
Product's Data:		Meets Req.	Does Not Meet Req.	Not Enough Info	Meets Req.	Does Not Meet Req.	Not Enough Info	
Fire Safety	R1: Flash Point 230C, Fire Point 250C R2: ASTM D56: Flash Point 230C	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	ASTM D 56: Flash Point (°C): <input type="checkbox"/> Grade 1, 188 <input type="checkbox"/> Grade 2, 196 <input type="checkbox"/> Grade 3, 196 <input type="checkbox"/> Grade 4, 221 <input type="checkbox"/> Fire Point (°C): <input type="checkbox"/> Grade 1, 216 <input type="checkbox"/> Grade 2, 221
Foaming Characteristics	Not Provided	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	ASTM D 892: (Protection From Hydraulic Cavitation) 100ml of foam, maximum after the 10 minute settling periods of both the first and second
Galvanic Corrosion	R1: FED-STD-791 Method 5322: No corrosion, pitting, or other attack	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	FED-STD-791 Method 5322: Not more than one disk may show signs of corrosion, pitting, or other attack
Kinematic Viscosity	R1: ASTM D 445: @-15C, 100cSt; @40C, 34.9cSt; @100C 10.0cSt	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	ASTM D 445: At 40°C: <input type="checkbox"/> Grade 1 btw 28.8 and 35.2 mm²/s(cSt) <input type="checkbox"/> Grade 2 btw 41.4 and 50.6 mm²/s <input type="checkbox"/> Grade 3 btw 61.2 and 74.8 mm²/s <input type="checkbox"/> Grade 4
Neutralization Number	R1: Neutralization Number 0.3 R2: ASTM D664, 0.3	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	ASTM D 664: Grades 1, 2, and 3: 1.5, maximum; Grade 4: < 0.2
Pour Point	R1: ASTM D97, Pour Point -20C	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	ASTM D 97: (Low Temperature Use) Fluid grade 1, 2, and 3: -12°C, maximum. Fluid grade 4, -6°C, maximum
Pump Wear Test	R1: ASTM D 2882: ring and vane weight loss, 10mg.	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	ASTM D 2882: Grades 1,2, and 3: The fluid shall have wear characteristics that provide a pump ring and vane weight loss of not greater than 50mg
Rust Prevention	R1: ASTM D 665, No Rust	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	ASTM D 665: Using procedure A, with the fluid, the test rod shall show no rust. Within the meaning of this test method, a rusted test rod is one on which
Toxicity	R1: Per MSDS: None of the components in this material are listed by TARC, MTP, or OSHA as	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	A-A-59354: The fluid shall not present a health hazard when used as intended

Biobased Hydraulic Fluid

Description: Vegetable oil based general purpose hydraulic fluid.
Manufacturer: Sample Company
P.O.C: John Doe
Address: Anywhere
Website:
E-mail Address:
Phone:
Biobased Content: 95%
Feedstock Type: Vegetable Oil

A-A-59290

	Specification Requirement:	Product's Data:*	Determination:
Ash content	ASTM D 1119: 0.52 percent by weight, maximum		Not Enough Info
Boiling Point	ASTM D 1120: 165° (329°F), minimum		Not Enough Info
Inhibitor Free alkalinity	ASTM D 1121: 0.05 to 0.75 g NaOH/100ml of sample, @ 25±3°C (77±5°F).		Not Enough Info
Inhibitor Specific Gravity	ASTM D 1122: 1.27±0.03 @ 25°C/25°C (77°F/77°F)		Not Enough Info
Kinematic Viscosity	ASTM D 445: 9.0 cSt, minimum at 37.7°C (100°F)	R1: ASTM D 445: @-15C, 100cSt; @40C, 34.9cSt; @100C, 10.0cSt	Meets
pH	ASTM D 1287: 7.2 to 7.8, value (50 percent aqueous solution by volume), @ 25° ±3°C (77±5°F)		Not Enough Info
Phosphate content	A-A-59290: 0.56 percent, minimum. (calculated as phosphoric acid)		Not Enough Info
Specific Gravity	ASTM D 1122: 1.111 to 1.123, undiluted material @ 15°C/15°C (60°F/60°F)		Not Enough Info

* R1 denotes data collected from product's data sheet. R2 denotes data received after a specific request.

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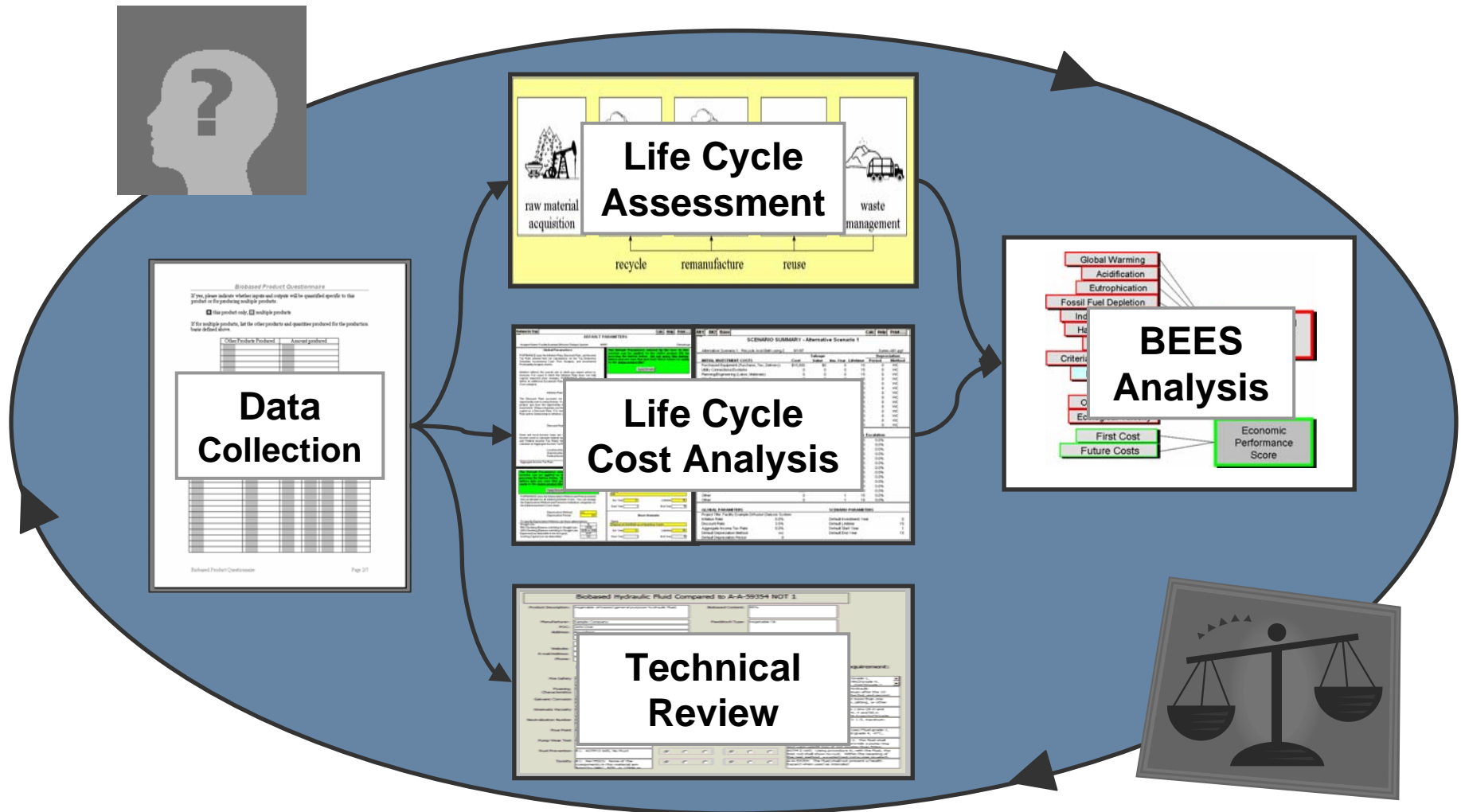
Biobased Hydraulic Fluid

	Specification Requirement:	Product's Data:*	Determination:
Fire Safety	ASTM D 56: Flash Point (°C): □ Grade 1, 188□Grade 2, 196□Grade 3, 196□Grade 4, 221□Fire Point (°C): □Grade 1, 216□Grade 2, 218□Grade 3, 218□Grade 4, 246	R1: Flash Point 230C, Fire Point 250C R2: ASTM D 56:Flash Point 230C, Fire Point 250C	Meets
Foaming Characteristics	ASTM D 892: (Protection From Hydraulic Cavitation) 100ml of foam, maximum after the 10 minute settling periods of both the first and second 24°C tests, and 25ml, maximum of foam after the 10 minute settling period of the 93.5°C test	Not Provided	Not Enough Info
Galvanic Corrosion	FED-STD-791 Method 5322: Not more than one disk may show signs of corrosion, pitting, or other attack.	R1: FED-STD-791 Method 5322: No corrosion, pitting, or other attack.	Meets
Kinematic Viscosity	ASTM D 445: At 40°C: □ Grade 1 btw 28.8 and 35.2 mm ² /s(cSt)□Grade 2 btw 41.4 and 50.6 mm ² /s□Grade 3 btw 61.2 and 74.8 mm ² /s□Grade 4 btw 135 and 165 mm ² /s	R1: ASTM D 445: @-15C, 100cSt; @40C, 34.9cSt; @100C, 10.0cSt	Meets
Neutralization Number	ASTM D 664: Grades 1, 2, and 3: 1.5, maximum; Grade 4: < 0.2	R1: Neutralization Number 0.3 R2: ASTM D 664, 0.3	Meets
Pour Point	ASTM D 97: (Low Temperature Use) Fluid grade 1, 2, and 3: -12°C, maximum. Fluid grade 4, -6°C, maximum	R1: ASTM D 97, Pour Point - 20C	Meets
Pump Wear Test	ASTM D 2882: Grades 1, 2, and 3: The fluid shall have wear characteristics that provide a pump ring and vane weight loss of not greater than 50mg	R1: ASTM D 2882: ring and vane weight loss, 10mg.	Meets
Rust Prevention	ASTM D 665: Using procedure A, with the fluid, the test rod shall show no rust. Within the meaning of this test method, a rusted test rod is one on which any rust spot or rust streak is visible by the inspection procedure.	R1: ASTM D 665, No Rust	Meets

* R1 denotes data collected from product's data sheet. R2 denotes data received after a specific request.

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Summary



Questions

Evaluating the Environmental Impact, Cost, and Performance of Biobased Alternatives

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